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CENTRAL PREDICTION AND THE JUNIOR COLLEGE TRANSFER.

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THE AUTHOR DESCRIBES A MODEL, "CENTRAL PREDICTION SYSTEM," FOR PREDICTING SUCCESS IN ONE OF SEVERAL SENIOR COLLEGES ON THE BASES OF TEST SCORES AND ACHIEVEMENT IN ONE OF SEVERAL JUNIOR COLLEGES. BASED ON ANALYSES OF THE 1962 JUNIOR CLASS AT THE UNIVERSITY OF FLORIDA AND THE FLORIDA STATE UNIVERSITY, TABLES WERE DEVELOPED FOR APPLICATION OF WEIGHTS AND PREDICTOR EQUATIONS TO INDIVIDUAL STUDENT SITUATIONS. THE AUTHOR INDICATES THAT THE SUGGESTED MODEL MAY BE APPLIED TO HIGH SCHOOL-COLLEGE PREDICTION AND JUNIOR COLLEGE-SENIOR COLLEGE PREDICTION. THIS ARTICLE IS PUBLISHED IN "COLLEGE AND UNIVERSITY," VOLUME 40, SPRING, 1965. (WO)

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Central Prediction and the Junior College Transfer

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THE PERIOD between junior college graduation and adjustment to a senior college upper division program is a student transition period that is receiving an increasing amount of attention. However, few systematic, comprehensive attempts to formulate statistical prediction systems for use at the junior year level have been conducted. There are several reasons for this. One reason has been the lack of valid sophomore comprehensive examinations; however, this problem is now being overcome (e.g., the new Educational Testing Service sophomore program). A second major reason is the lack of homogeneity among institutional grading practices. This report is a discussion of a method for solving this second problem—the central prediction system.

The term "central prediction system" refers to any centralized method of predicting success in one of several senior colleges on the basis of test scores and achievement in one of several junior colleges. A central prediction system differs from customary prediction methods in several respects. Information from all junior and senior colleges in a given school system are included. The system takes into account differences in grading practices among institutions, thus greater predictive accuracy is possible. Predictions for all possible courses of action open to students can be made, thus providing extensive guidance flexibility.

The statistical method that will be discussed is the writer's modification of a technique developed by Tucker (1960). The locale for the application that will be discussed is Florida.

Many states, including Florida, are developing higher education systems consisting of junior colleges, four-year colleges, and universities. For the most part, matriculation between the units involves relatively closed transfer systems. By this is meant that the majority of students transferring to one of the senior institutions of a particular state transfer from one of the junior colleges in the state; conversely, the majority of students who transfer from one of the junior colleges in the state transfer to one of the senior colleges in the state. The central prediction techniques are potentially valuable in these situations.

FLORIDA JUNIOR COLLEGES

In Florida central prediction can be especially valuable because of the vast junior college system, the development of upper division undergraduate colleges, and the suspension of the usual admissions requirements in the case of junior college graduates of college-parallel programs. A description of the development of Florida's junior college system is given subsequently to clarify the importance of the study to this State.

The impetus for the development of a strong junior college program in Florida has come largely from the recommendations of the Community College Council of Florida, an advisory board established by the 1955 Legislature. The council recommended a long-range program of expansion of junior college facilities so that the increasing number of students could receive appropriate education near their homes for two years beyond high school. Recognizing the probable articulation problems, the council recommended the establishment of a liaison committee which was to advise on transfer policies. The State undertook the expansion of this aspect of its educational system and the junior college system was increased from five colleges in 1955 to twenty-nine in 1962. The accompanying college level enrollment increase was from 2,500 to over 29,000.[1] The junior colleges expect to enroll 100,000 students by 1970.[2] About one-third of the freshmen entering the junior colleges will transfer to a Florida university.

A second development in Florida higher education is the experimentation with upper division undergraduate colleges. These colleges will have no freshmen or sophomore classes and each will depend on a particular set of junior colleges to provide most of its student body. One of these colleges will receive its first junior class in the fall of 1961. A second is being planned.

A third factor is important. The problems of articulation between junior and senior colleges are intensified since many of these students would not have qualified for admission to the universities as freshmen. The present admissions policy at the public universities is that

[1] "Enrollment Fall 1962, Florida Public Junior Colleges." Mimeographed report of the Division of Community Junior Colleges, State Department of Education, Tallahassee, Florida, October, 1962.

[2] F. H. Kent, Address to the Governor's Conference on Higher Education, Tallahassee, Florida, May 29-30, 1962.

only students who stand in the upper 40 per cent of all Florida twelfth grade students can be admitted. The identification of the top 40 per cent is based on scores earned on a State-wide senior testing program. Students who belong to the eligible group may enter either a public university or a public junior college. Students who do not belong to the eligible group may enter a junior college. Students in this latter group may transfer to the junior class of a public university if they achieve satisfactory grades in the college parallel curriculum of a junior college.

The need for this study is based partially on the fact that very little effort has been given to predicting the upper division success of junior college transfer students. A study of a recent class of Florida junior college transfer students was made by the writer. The study compared the junior-year grades of transfer and native students. One finding was a significant interaction effect of student origin with major area of study. A second important finding was that, at one university, the test data used were more highly related to transfer student success than to native student success. This was shown by a significant interaction of ability with student origin. Although grade prediction was not a goal of the study, the results did emphasize the need for prediction studies at this level.

The dynamic growth of the Florida junior college system will continue and will certainly introduce instability into any statistical study of the system. Each junior college may not have yet developed unique characteristics which might significantly relate to criteria being predicted. It is assumed that the study reported in this paper will constitute a first step in the direction of appropriately handling prediction studies.

STATISTICAL METHODOLOGY

Several investigators have been concerned with the problem of institutional differences in grading practices and the effect of these differences on statistical predictions. The first investigation of any importance was reported by H. A. Toops in 1933. Perhaps the most important recent research was reported by L. R. Tucker in 1956. Tucker formulated highly general mathematical models that could be used for problems involving several junior colleges, several senior colleges, several test scores, and several criterion measures. One of Tucker's models was a prediction model designed to provide predic-

tions of specific criteria. A modification of Tucker's prediction model was made by this writer which corrected an omission by Tucker. This modified model is the technique that will be discussed subsequently.

A basic assumption underlying the model is that the distributions of junior college grade averages (used as predictors) and the distributions of senior college grade averages (used as criteria) are not the same among institutions. A similar assumption is that the relationships between the predictor variables and the criterion variables are not the same among institutions. This "heterogeneity assumption" is accounted for in the model by the inclusion of special corrections for institutional dissimilarities. If, in a particular application, this assumption is false, then the use of the central prediction model, rather than the traditional linear multiple regression model, will result in unnecessary numerical work.

The mathematical formulations and calculation schemes for the modified central prediction analysis will not be discussed. These have been described elsewhere by the writer and by Tucker. A computer program is available for the calculations.

The results of the modified central prediction analysis are several. First, a multiple correlation coefficient is calculated for each senior college. These coefficients show the accuracy with which grades at each college are predicted. Second, a regression equation is produced for each college so that a prediction for each senior college can be made for any student attending any junior college. Third, sets of weights are obtained to adjust junior college grades according to the junior college attended by the students. These outcomes might best be understood by the example application described in the next section.

AN EXAMPLE APPLICATION

The population for this study consisted of members of the 1961-1962 junior class of two Florida State universities, the University of Florida (UF) and the Florida State University (FSU), both having predominantly Caucasian student bodies.

The population was divided into two groups and subjects were selected from each. The first group consisted of every student who had transferred from a Florida public junior college and who had transferred sufficient credit to be classified as a junior. The second group consisted of a random sample of junior students who had earned all of their lower division credits at the institution in which they were

then enrolled. These students compose what are subsequently called the "native" student samples.

Subjects were then classified according to the university they were attending and the major they were pursuing. The major concentration consisted of three categories, social sciences (SS), natural sciences (NS), and humanities (H).

Consequently, there were six two-way classifications of "university" and "major." Each of these eight groups is called a "college" in the remainder of this report.

The criterion variable was the grade point average each subject attained during his junior year. Although first semester grades are generally used in prediction studies, second semester grades are included here to add stability to the criterion data.

The major independent variables were the subjects' junior college grade point averages and their scores on the *Florida State-Wide Twelfth Grade Testing Program*. These variables were used because the official University System entrance requirements are based on them. Incoming freshmen are required to have a satisfactory score on the test battery and transfer students are required to have earned satisfactory grades at the school from which they transfer. The *Florida State-Wide Twelfth Grade Testing Program* consists of the *American Council on Education Psychological Examination* (PSY), the *Cooperative English Test* (ENG), and the *Cooperative Achievement Tests in Social Studies* (SOC), *Natural Sciences* (SCI), and *Mathematics* (MS).

The results of the central prediction system are two sets of weights. The first set of weights appears in Table I. The weights in Table I define three predictor composites. The number of composites depends on the nature of the data; the maximum number is equal to the number of colleges in the study (or six, in the example). The predictor composites are used in the prediction equations appearing in Table II.

The use of these tables will be illustrated by an example. Suppose a student attending JC-5 wants to know his predicted junior year grade at UF SS. Suppose that he has achieved a grade average of 3.00 and has test scores of 80 on each test. Table I gives the weights for obtaining the student's three composite scores. His composite score, X_1, is given by $X_1 = (.86 \times 3.00) - 2.33 + (.05 \times .80) + (.07 \times .80) + (.05 \times .80) - (.09 \times .80) - (.06 \times .80)$ or $X_1 = .27$. The composite scores X_2 and X_3 are calculated from the other

TABLE I

PREDICTOR COMPOSITE SCORE WEIGHTS FOR MODIFIED CENTRAL PREDICTION SYSTEM (UF AND FSU)

Variable		*Weights*		
		Composite One	*Composite Two*	*Composite Three*
JC-1	grade	.86	−.19	.42
	constant	−2.45	−.36	−.12
JC-2	grade	1.11	−.38	.35
	constant	−2.48	−.38	−.15
JC-3	grade	.78	−.43	.35
	constant	−2.47	−.42	−.12
JC-4	grade	.67	−.50	.64
	constant	−2.50	−.44	−.07
JC-5	grade	.86	−.18	.47
	constant	−2.33	−.38	−.11
JC-6	grade	.61	−.59	.57
	constant	−2.51	−.46	−.09
JC-7	grade	.96	−.64	.24
	constant	−2.44	−.49	−.18
JC-8	grade	.79	−.64	.11
	constant	−2.48	−.49	−.18
JC-9	grade	.69	−.44	.24
	constant	−2.41	−.43	−.16
PSY[a]		.05	.50	.20
ENG[a]		.07	.12	−.59
SOC[a]		.05	−.02	−.21
SCI[a]		−.09	−.47	−.69
MS[a]		.06	.54	.30

[a] Test scores were multiplied by the scale factor .01.

TABLE II

REGRESSION EQUATIONS FOR MODIFIED CENTRAL PREDICTION SYSTEMS

College	*Regression Equation*
UF SS	$Y = .53X_1 - .30X_2 + .14X_3 + 2.19$
UF NS	$Y = .43X_1 + .07X_2 + .27X_3 + 2.22$
UF H	$Y = .61X_1 + .17X_2 + .15X_3 + 2.46$
FSU SS	$Y = .73X_1 - .19X_2 + .15X_3 + 2.60$
FSU NS	$Y = .63X_1 + .32X_2 + .03X_3 + 2.73$
FSU H	$Y = .70X_1 - .06X_2 + .05X_3 + 2.82$

two sets of weights. They are · .38 and .51, respectively. These values are entered into the UF SS equation in Table II. The prediction is Y = (.53 × .27) -- (.30 × [·· .38]) · (.14 × .51) + 2.19 or Y = 2.38.

The multiple correlations corresponding to each of the prediction equations are

UF SS —. 56,
UF NS — .60,
UF H — .71,
FSU SS — .61,
FSU NS — .71, and
FSU H — .57.

DISCUSSION

Some comments on these results are appropriate. First, in actual application, the calculation of specific predictions can be considerably simplified by combining the two sets of weights. In fact, the amount of calculation will be exactly the same for this method as is the case for multiple linear regression analyses. Since the technique is designed for centralized applications, the agency conducting the analyses can mechanically make and report all possible predictions for all subjects.

Second, the small size of the multiple correlations can be partially explained. The test data utilized in the example were gathered three years before the criterion measures were obtained. With the advent of new sophomore level testing programs, more valid test scores will be available for prediction studies. Of course, the size of the correlations are also a function of the range of ability of the groups involved, and, in the case of upper division students, the ability range is largely limited to the academically talented. On the other hand, the size of the correlation is limited by the reliability of the criterion. Academic grades are notoriously unreliable and it is possible that validity coefficients cannot be improved too much over these reported here.

There are other situations in which sound applications can be made. One is that of any senior high school or group of high schools that has a particular group of junior high schools feeding it. Also, many junior colleges or community-oriented four-year colleges can use a central system for predicting freshman performance since the majority of the student bodies are likely to have graduated from local high schools.

One of the advantages of the modified central prediction analysis is the flexibility that it affords guidance personnel. By knowing a student's grade average and test scores, and knowing which school was attended, the counselor can provide his counselee with information concerning his expected success at various universities or in various academic areas of study. University personnel can make similar admissions decisions. The results will provide admissions personnel with information about the relative emphasis to place on previous academic achievement depending on the institution attended by the applicant.